



Case Report

Orthodontic treatment of skeletal Class III with mandibular repositioning using the GEAW technique: A case report

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Abstract

Objective: To report the non-surgical correction of skeletal Class III in an 11-year-old boy using clockwise mandibular repositioning in combination with GEAW (Gummetal Edgewise Archwire) mechanics.

Materials and Methods: Posterior bite-raising was used to unlock the mandible and register an edge-to-edge incisal position for cephalometric analysis (Ricketts). Leveling/alignment were performed with nickel-titanium archwires, followed by space regaining with coils and multiloop mechanics. Rectangular Gummetal 16×22 then 17×22 archwires delivered GEAW forces, combined with short Class III and vertical elastics to control the vertical dimension and obtain clockwise mandibular rotation.

Results: After 22 months, bilateral Class I relationships, positive overjet/normalized overbite, coordinated arches, and improved soft-tissue profile were achieved without TMJ symptoms.

Conclusion: In growing patients with a mesofacial pattern, controlled posterior extrusion with GEAW can facilitate clockwise mandibular rotation and reduce the clinical appearance of skeletal Class III without surgery.

Keywords: Skeletal Class III, MEAW/GEAW, Gummetal, Vertical control, Clockwise rotation, Mandibular repositioning

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1. Introduction

Skeletal Class III malocclusion may arise from mandibular prognathism, maxillary deficiency, or both. Early orthodontic intervention can mitigate the discrepancy and reduce the need for orthognathic surgery.¹ The Multiloop Edgewise Archwire (MEAW) system provides vertical and sagittal control via differential moments and controlled extrusion/uprighting of posterior segments.^{2,3,4,5} GEAW adapts these principles with a β -titanium alloy (Ti-Nb-Ta-Zr-O, “Gummetal”) characterized by low elastic modulus and high springback, enabling light continuous forces and precise bending.^{6,7} This case illustrates GEAW mechanics to attain clockwise mandibular rotation and functional correction in a growing skeletal Class III patient.

2. Case Presentation

An 11-year-old male presented (July 2023) with anterior crossbite, crowding, and an unaesthetic smile. Extraoral

examination showed a concave profile, mild right-sided smile deviation, and a low smile line (~50% maxillary incisor display). Intraorally there was severe crowding (#13, #23, #42 displaced), narrow maxillary and mandibular arches, lingually tipped mandibular posteriors, anterior crossbite (OJ –2 mm) with deep overbite (OB 7 mm), retroclined incisors (negative torque), 2-mm rightward mandibular midline deviation, and posterior crossbite (#14, #45).



Figure 1: Pre-treatment extra-oral photographs

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Figure 2: Pre-treatment intra-oral photographs



Figure 3: Pre-treatment panoramic radiograph

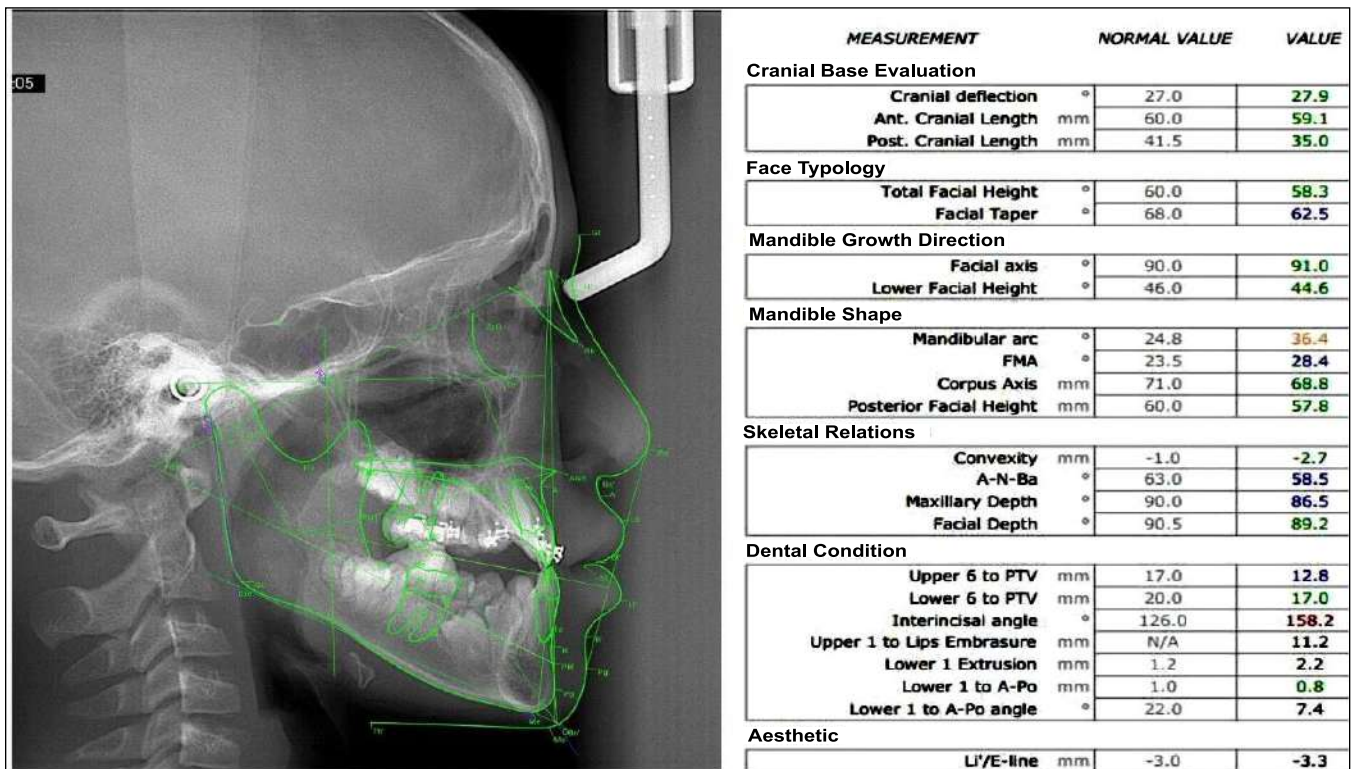


Figure 4: Pre-treatment cephalometric radiographs and cephalometric analysis

2.1. Radiographic findings

2.1.1 Panoramic Radiograph

Panoramic radiography indicated developing third molars (#28, #38, #48) and exfoliating #65 and #75

3. Lateral Cephalometric Analysis (Ricketts)

To assess repositioning potential, the posterior occlusion was raised with glass-ionomer to guide the incisors into an edge-to-edge position, and a lateral cephalogram was taken in this open-rotation posture for Ricketts analysis.⁸

In this posture, anteroposterior mandibular projection normalized (Convexity -2.7 mm; Facial Depth 89.2°) while the vertical pattern remained mesofacial (FMA 28.4° , Facial Taper 62.5° , LFH 44.8% , TFH 58.3%).

Both arches exhibited lingually inclined incisors consistent with Class III compensation.

4. Temporomandibular Joint (TMJ) Examination

1. No clicking sounds detected.
2. Smooth and regular opening and closing movement.
3. No TMJ pain upon clinical examination or reported in medical history.

5. Diagnosis

Skeletal Class III with anterior crossbite, deep bite, posterior transverse discrepancy, crowding, and low smile line.

6. Treatment Objectives

1. Establish positive overjet and normalize overbite.
2. Achieve bilateral Class I relationships with coordinated arch forms.
3. Use controlled posterior extrusion to induce clockwise mandibular rotation without excessive lower facial height increase.
4. Decompensate incisor inclinations within periodontal limits.
5. Correct transverse discrepancy and midlines.
6. Maintain TMJ comfort.

7. Treatment Alternatives

Considered options included:

1. Protraction facemask with expansion (age/mandibular dominance reduced prognosis).⁹
2. Skeletal anchorage–assisted distalization.
3. Deferring treatment to orthognathic surgery in adulthood.

Given the favorable diagnostic response to bite-raising, a non-surgical approach with GEAW was selected.

8. Treatment Progress and Biomechanics

Self-ligating MBT 0.018-inch brackets were used. Initial leveling/alignment employed 0.014- and 0.016-inch NiTi with posterior bite-blocks. Space regaining for #13 used open-coil on 0.016-inch NiTi. A modified open-activating wire on Blue Elgiloy created space around #42. Working phases used rectangular Gummetal 16×22 then 17×22 archwires (GEAW). Short Class III elastics ($3/16''$, 4–6 oz) and vertical elastics at #4–#5 extruded premolars to increase OVD and guide clockwise mandibular rotation, while maxillary transverse coordination used a Mulligan-type 0.032-inch auxiliary. Bite-blocks were removed gradually as anterior guidance developed; finishing used segmented elastics to refine intercuspation.

Retention included a maxillary wraparound and a mandibular bonded retainer.

Total treatment time: 22 months.

9. Treatment Progress by Stages



Figure 5: Posterior bite raise using glass ionomer cement

Space regaining for #13 used open-coil on 0.016-inch NiTi



Figure 6: Space creation for alignment using the MOAW archwire

1. MOAW: used on Blue Elgiloy (BE).
2. Double helix loop between #43–#41 to create space for #42.
3. Elastics: Short Class III ($3/16''$, 4.5 oz), progressing to 6 oz.



Figure 7: Alignment using a straight wire

Level and align the teeth using 0.016 NiTi archwire once sufficient space has been created



Figure 8: GEAW archwire applied on Gumetal wire

10. GEAW : Used on Gumetal 1622 → 1722 Archwires



Figure 9: Steps of using GEAW to treat Class III malocclusion, with class III short elastics

1. **Vertical control:** Extrusion of #4–#5 using inter-arch elastics, gradual removal of bite blocks. Continue using short Class III inter-arch elastics ($3/16''$, 6 oz) to correct the anterior crossbite.
2. **Maxillary expansion:** Mulligan 0.032" Gumetal.



Figure 10: Intercuspal phase: segmental archwire sectioning and interarch elastics for occlusion closure

Continue significantly increasing the vertical dimension (OVD) by using inter-arch elastics between upper and lower premolars (#4–5) bilaterally, along with short Class III elastics (3/16", 6 oz), until achieving a bilateral Class I premolar relationship and establishing a positive overjet in the anterior region. Subsequently, perform segmental archwire cutting and use inter-arch elastics to close the bite and establish proper occlusal intercuspation.

11. Brackets were Removed after 22 Months of Treatment



Figure 11: Post-treatment intra-oral photographs



Figure 12: Extraoral photographs after orthodontic treatment

11.1. Before-and-after comparison



Figure 13: Pre- and post-treatment comparative photographs

11.2. Post-treatment radiographs

11.2.1 Panoramic X-ray

The patient is scheduled for third molar extractions one year after treatment.



Figure 14: Post-treatment Panoramic radiograph

11.2.2. Cephalometric X-ray

Cranial Base Evaluation			
Cranial deflection	°	27.0	28.7
Ant. Cranial Length	mm	60.0	55.3
Post. Cranial Length	mm	41.5	37.2
Face Typology			
Total Facial Height	°	60.0	55.4
Facial Taper	°	68.0	62.3
Mandible Growth Direction			
Facial axis	°	90.0	90.5
Lower Facial Height	°	46.0	41.2
Mandible Shape			
Mandibular arc	°	24.8	37.6
FMA	°	23.5	26.5
Corpus Axis	mm	71.0	65.5
Posterior Facial Height	mm	60.0	59.3
Skeletal Relations			
Convexity	mm	-1.0	-4.1
A-N-Ba	°	63.0	58.3
Maxillary Depth	°	90.0	87.1
Facial Depth	°	90.5	91.2
Dental Condition			
Upper 6 to PTV	mm	17.0	13.4
Lower 6 to PTV	mm	20.0	12.8
Interincisal angle	°	126.0	127.9
Upper 1 to Lips Embrasure	mm	N/A	9.8
Lower 1 Extrusion	mm	1.2	2.3
Lower 1 to A-Po	mm	1.0	1.7
Lower 1 to A-Po angle	°	22.0	23.6
Aesthetic			
Li'/E-line	mm	-3.0	-2.0

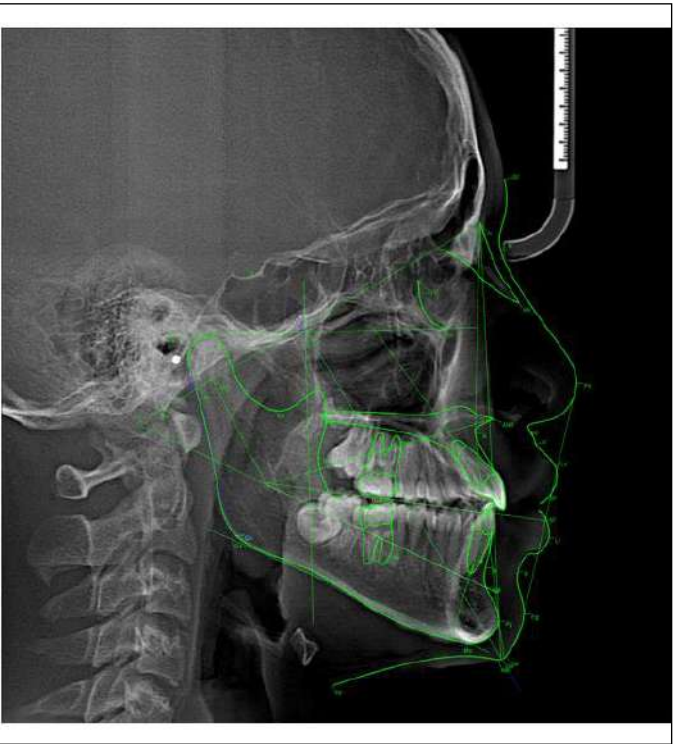


Figure 15: Post-treatment cephalometric radiograph and Ricketts analysis

12. Results

1. The teeth were aligned and leveled to establish proper occlusion.
2. Class I occlusal relationship achieved.
3. Correct overjet and overbite restored.
4. Midlines aligned.
5. Improved facial profile and smile symmetry.

12.1. Skeletal and dental changes

1. Clockwise mandibular rotation associated with posterior vertical development.
2. Labial uprighing of maxillary incisors and mild decompensation of mandibular incisors, producing positive overjet.
3. Posterior uprighing with adjustment of the functional occlusal plane.
4. Transverse development correcting posterior crossbite.

These findings agree with MEAW literature showing that posterior uprighing and controlled anterior extrusion can close the bite and improve sagittal relationships, especially in growing Class III cases.^{2,3,4,5,10,9,11} Gummetal provides low load–deflection with high springback, enabling gentle continuous forces for three-dimensional control.^{6,7,12}

13. Discussion

This case underscores the importance of diagnostic bite-raising: normalization of Facial Depth and edge-to-edge incisor

contact predicted a favorable response to vertical control and occlusal plane remodeling. MEAW/GEAW mechanics generated differential moments that uprighted posteriors and adjusted torque, facilitating mandibular clockwise rotation without surgery. Our clinical outcome is consistent with reports of Class III camouflage using multiloop mechanics (with or without auxiliaries) that document occlusal plane change and improved soft-tissue balance.^{4,13,10,9,11,14} Regarding material choice, the β -titanium Ti-Nb-Ta-Zr-O alloy (“Gum-metal”) exhibits low elastic modulus and high strength/elastic deformability, supporting precise bends and biologically compatible forces.^{6,15,7} Although high-level comparative trials for GEAW specifically are limited, systematic and narrative reviews indicate acceptable stability when vertical control and retention are rigorous.^{5,11,16}

14. Conclusion

Clockwise mandibular repositioning combined with GEAW mechanics provided functional occlusion and profile improvement in a growing skeletal Class III patient, avoiding surgery while maintaining a balanced vertical pattern.

15. Source of Funding

None.

16. Conflict of Interest

None.

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